

# Observations on the nesting behaviour of the Bar-bellied Pitta *Pitta ellioti*

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The Bar-bellied Pitta *Pitta ellioti* is a highly distinctive species which is endemic to Cambodia, Laos, Thailand and Vietnam (Delacour & Jabouille 1931, Lekagul & Round 1992). In Vietnam, Bar-bellied Pittas inhabit lowland broad-leaved evergreen and broad-leaved semi-evergreen forests up to 800 m asl, where they have recently been shown to be common and widespread in primary, logged and secondary forests and consequently are not believed to be of conservation concern (Eames *et al.* 1992). Accordingly, the species is no longer assigned an IUCN category of threat but has been retained as a near-threatened species (Collar *et al.* 1994). Aside from this rudimentary understanding of the species' range, habitat and status, its biology and nesting behaviour have remained undescribed in the literature.

## Study site and methods

The study was conducted between 2 and 28 June 1995 in lowland broad-leaved evergreen forest at 50–300 m asl, in the proposed Ke Go Nature Reserve (18°07'N, 105°55'E) in Ha Tinh Province and in contiguous forest in adjacent Quang Binh Province in central Vietnam. Four nests were discovered quite incidentally whilst undertaking ornithological and botanical surveys. They were identified as being those of *P. ellioti* either by the direct observation of the species at the nest, as in the case of nests 1, 2 and 4, or observation of adults close to the nest, as in the case of nest 3. I was able to make observations only at irregular intervals, and so could not collect data systematically. However, a small hide constructed with natural vegetation was built 4 m from nest 1 on 25 June, from which I made 12 hours of continuous observations on 27 June. Observations were made using 8 × 42 binoculars and the viewfinder of a camera mounted with a 70–210 mm lens, and almost every nest visit was photographed (Figures 1–4).

## Results

### Nests

Four nests were discovered, of which three were active. Nest 1 was found on 2 June, situated in the apex of the branching fronds of a palmate palm *Licuala* sp., 7 m from a logging track, 13 m from a small forest clearing and 15 m from a forest stream. The nest was a dome constructed with small twigs, dry dicotyledonous leaves and leaf skeletons. It was lined with finer material particularly leaf veins 50–70 mm in length, many of which were tentatively identified as belonging to the Papilionaceae. Additionally, the nest was lined with

TABLE 1  
Nest-sites of *Pitta ellioti*

Nest no.	Forest status	Canopy height (m)	Altitude (m asl)	Slope (degrees)	Site aspect	Distance from forest edge (m)
1	Secondary	15	240	3-4	East	13
2	Primary	20	300	15	South-west	>100
3	Secondary	12	180	1-2	North-east	3
4	Secondary	20-22	180	1-2	North-west	>100

fine 'rootlets' up to 130 mm in length, perhaps belonging to the fern *Lygodium* sp. Nest 2 was discovered on 3 June; it too was situated in the apex of the branching fronds of a palmate palm *Licuala* sp., and was located within 1 m of a forest trail. Again, the nest consisted of a dome and was constructed from dry palm *Licuala* sp., rattan *Calamus* sp. and bamboo Bambusoideae leaves. It was lined with similar material to the first nest. Nest 3, discovered on 8 June, was built in a rattan *Calamus* sp., within 3 m of an old logging road. The nest consisted of a steep-sided bowl and lacked a roof. It was constructed from dry dicotyledonous, palm *Licuala* sp. and rattan *Calamus* sp. leaves, and lined with leaf veins. Nest 4 was discovered on 7 June and was built amongst both living and dead rattan *Calamus* sp. stems, through which a palmate palm *Licuala* sp. was growing, within 1 m of a forest trail. Like the first two nests, it was domed. For full details of nest site and dimensions, see Tables 1 and 2.

### Eggs

On 2 June nest 1 was freshly lined and was empty; by 11.30 hrs on 3 June it contained a single egg. During the afternoon of 8 June I flushed the female off the nest which was then found to contain two warm eggs. The eggs measured  $29 \times 22$  and  $29 \times 23$  mm. Both eggs were creamy white, speckled with chestnut. On 3 June nest 2 contained four ovate eggs. All four eggs measured 29 mm in length, three measured 25 mm at their widest point and one 24 mm. The eggs were creamy white; two were entirely unmarked, whilst two had indistinct brown speckles at their broad end. On 7 June nest 4 contained three eggs, but their size and coloration was not noted at the time. On inspecting the nest on 9 June the remaining egg was white, covered with brown blotches, and measured  $28 \times 22$  mm.

### Nest attendance

During 12 hours of uninterrupted observation of nest 1 on 27 June, the pair visited the nest 40 times, comprising 23 lone visits by the female, 15 lone visits by the male, and one visit by the pair together. The male twice visited the nest but neither brought food nor removed faecal sacs. On both occasions he looked into the nest as if inspecting the contents. The female made only one such visit. At 08.28 hrs

TABLE 2  
Features and dimensions of *Pitta ellioti* nests

Nest no.	Site and height (m)	Shape	Height from ground (m)	Depth × width × height (mm)	Entrance (mm) width × height, aspect	Platform length × width (mm)	Chamber depth × width (mm)
1	<i>Licuala</i> sp. c. 2 m	dome	1.32	140 × 180 × 230	110 × 70-90 SW	150 × 120	140 × 130
2	<i>Licuala</i> sp. 2.5 m	dome	1.68	200 × 190 × 220	100 × 100 NE	130 × 60	150 × 100
3	<i>Calamus</i> sp.	cup	1.75	— × 350 × 170	N/A E	160 × 100	110 × 120
4	<i>Calamus</i> sp. 3 m	dome	1.65	210 × 260 × 180	100 × 60 SW	90 × 120	

two Rufous-throated Fulvettas *Alcippe rufogularis* visited the palm in which the nest was located. Neither adult was at the nest. One of them, which was not visible but in the vicinity, reacted by giving the subdued *weo* call (see below) but did not approach the nest.

### *Nest predation*

At 06.30 hrs on 27 June nest 1 was visited by a Northern Tree Shrew *Tupia belangeri*. The tree shrew approached the nest from the ground and climbed the stem of the palm, at first by-passing the nest entrance but then finding its way onto the roof of the nest. It then descended to the front of the nest, entered it, and almost immediately began devouring a living pullus from the seclusion of the nest chamber.

Nest 3 was checked for only the second time on 28 June, when it was found to be partially destroyed and not in use. There was no evidence that this nest had been used for nesting during the survey period. By 28 June nest 4 contained merely the decomposed heads of two pulli and a single pullus wing in pin, clearly indicating predation.

### *Nestling care, diet and growth*

After only a few minutes the tree shrew, which had raided nest 1, abandoned the partially eaten pullus and possibly as a result of the calls of the adults, it left the nest-palm. Both adults then flew up to the nest and shielded the nest with their bodies, partially opening their wings. The tree shrew subsequently returned to the nest about 15 minutes later but I drove it off to prevent predation of the remaining living pullus. During 12 hours of nest observation, both sexes fed the young and removed faecal sacs. The number of visits per hour varied between 0 and 6, with a mean of 3. Of 36 food items observed, 21 (60%) were Annelid worms, 2 consisted of white grub-like larvae (Figure 2) and 13 items were unidentified, many of which may have been Annelid worms. Feeding visits were quite brief, lasting 2–3 seconds. On the occasion of the first visit of the female, following the nest predation, she ate the prey items (Annelid worms) herself. The female was seen to remove faecal sacs seven times, the male only once (Figures 3 and 4). The female was twice observed, and the male once, eating something from inside the nest, possibly the contents of ruptured faecal sacs. The female attempted to remove the dead pullus from the nest at 15.38 hrs but failed after one attempt; she finally removed the corpse at 16.35 hrs on 27 June. Its weight pulled her down to the ground; after recovering herself she flew off low across the forest floor carrying the dead pullus in her bill.

On 25 June, nest 1 contained two well-grown pulli, whose feathers were just beginning to emerge from pin. On 28 June, the surviving pullus in nest 1 weighed 54 g. By 8 June, nest 3 contained a single pullus and the following day this had increased to two pulli, the second of which had hatched that morning. Additionally, and unconnected with any of the four nests, a fully fledged *P. ellioti* was observed on 3 June.





Figure 1. Male *Pitta ellioti* at the nest. (Photo: J. C. Eames.)



Figure 2. Female *Pitta ellioti* feeding young with a white grub. (Photo: J. C. Eames.)

### *Nestling behaviour*

When nest 1 was approached on 25 June, the pulli retreated to the rear of the nest, prostrated themselves on the floor and then raised their abdomens and 'bristled' their pin feathers in what was obviously a defensive posture, rather reminiscent of a porcupine *Hystrix* sp. The



Figure 3. Female *Pitta ellioti* removing faecal sac. (Photo: J. C. Eames.)



Figure 4. Male *Pitta ellioti* removing faecal sac. Note that the pullus is presenting its cloaca to the male. (Photo: J. C. Eames.)

surviving pullus repeated this stance when the nest was approached on 28 June. When it was handled prior to being weighed, it immediately ejected a faecal sac which burst on the dorsal side of the abdomen.

On 27 June, whilst waiting to be fed, the surviving pullus frequently tried to catch airborne insects, including flies which were presumably



attracted to its decomposing sibling. Periodically it closed its eyes and became inactive, presumably sleeping; on other occasions it was quite active, moving around the inside of the nest. On two occasions, immediately after being fed, the pullus turned around and presented its cloaca to the adult in attendance, it then ejected a faecal sac which was removed directly from the cloaca by the adult (Figure 4).

#### *Calls of adults and young*

Both adults were in the immediate vicinity of nest 1 during its predation. Immediately one of the adults began uttering a rather subdued *weo*, as if made through the teeth of a comb screened with tissue paper. Shortly afterwards the female flew to and perched on a liana about 4 m from the nest and 1 m above the ground, from where she repeated this call. The male continued calling from around the nest. During this bout of calling, the calls of both adults changed to a loud, exclamatory *skew*. Whilst approaching the nest both adults uttered soft *coo*-like calls. In response to the calls of the approaching adults the pullus made a soft *chip* note and a 'tweeting' of the kind typically associated with young birds or nestlings. The pullus frequently called and became active in response to other background forest noises. The adults gave the typical *skew* call when alarmed and at dusk from the vicinity of the nest. The trisyllabic territorial call rendered as *tu-wi-whil* (Lekagul & Round 1991) was not recorded from the vicinity of the nest.

### Discussion

The discovery of three active nests during the first ten days of June provided the opportunity for an in-depth study of the breeding biology of *P. ellioti*. However, being otherwise committed I was able to make only brief but detailed observations at one nest, whilst the other nests were only intermittently observed. In the following discussion comparisons are drawn between the Bar-bellied Pitta's nests and those of other pitta species for which data were available.

Three of the *P. ellioti* nests were of a similar dome-like construction. Lacking a roof nest 3 was a little atypical, but since it had been lined it can be assumed that it had been completed. All four nests were constructed of similar materials and had similar dimensions (Table 1). Their mean measurements for depth  $\times$  width  $\times$  height were 183  $\times$  245  $\times$  200 mm. The mean entrance width  $\times$  height measured 103  $\times$  80 mm. The mean platform length  $\times$  width was 132  $\times$  100 mm and the mean nest chamber depth  $\times$  width was 133  $\times$  116 mm.

There are few detailed descriptions of pitta nests but fortunately one such case is that of *P. gurneyi*, which is one of the species most closely related to *P. ellioti*. These two species are of a similar size, the plumage patterns of the males are very similar and plumage patterns and coloration of the females virtually identical. Both species inhabit lowland broad-leaved evergreen forest, *P. gurneyi* exclusively so (Round & Treesucon 1986).

A nest of *P. gurneyi* was described as a flattened dome 180 mm deep, with an external horizontal diameter of 190 mm and an internal

TABLE 3  
 Statistics for nests of three *Pitta* species

Species	Hatching date	Earliest nest visit	Latest nest visit	No. of feeds observed (♂:♀)	% Annelid worms in diet	No. of faecal sacs removed/hour
<i>P. ellioti</i>	8-9/6	06.15 h	18.18 h	13:22	60	0.83
<i>P. gurneyi</i>	15-17/6	06.18 h	18.28 h	35:28	73	0.91
<i>P. caerulea</i>	31/7-2/8	>06.00 h	<19.00 h	93:73 (visits)	34	0.55

diameter of 160 mm. The entrance was approximately 140 mm wide and 110 mm high. Thus it was similar in size and shape to the nest of *P. ellioti*. The materials used were also similar; the Gurney's *Pitta* nest was constructed of bamboo leaves and the leaves of unidentified broad-leaved plants, the floor being a shallow cup lined with black rootlets (Round & Treesucon 1986).

No consistency was evident in the choice of nest site amongst the four *P. ellioti* nests since altitude, aspect and slope varied (Table 1). All four nests were situated close to or on trails, reflecting observer bias as no off-trail nest searching was attempted. Three of the nests were located in disturbed secondary forest and one nest in primary forest. The Gurney's *Pitta* nest was in secondary forest with tree height in the range 15-20 m, 50 m from a logging road. Four nests of the Giant *Pitta* *P. caerulea*, a larger sundaic species, were located in secondary forest and a fifth nest in a fragment of primary forest 10 m from the forest edge (Round *et al.* 1989). Thus, all three species are able to nest in secondary forest formations, which suggests that in terms of nest site they are to some degree adaptable and ecologically tolerant. Any possible significance in the proximity of nests to forest edge is unknown.

Two of the *P. ellioti* nests were built in palmate palms *Licuala* sp., the third in a rattan *Calamus* sp., and the fourth in a rattan *Calamus* sp. through which a palmate palm *Licuala* sp. was growing. The nest of *P. gurneyi* was in the rattan *Salacca rumphii*, whilst the nests of *P. caerulea* were in *Calamus* sp., *Licuala* sp. and a rattan *Daemonorops* sp. A nest of the Blue-rumped *Pitta* *P. soror* has been recorded in a rattan of the subfamily Calamoideae (Lambert *et al.* in press). Thus, the locations of the four *P. ellioti* nests in palms, within the subfamilies Coryphoideae and Calamoideae, are apparently typical for the genus.

In all three *P. ellioti* clutches the eggs were of a similar size and ground coloration, but they varied in the degree and extent of their markings. In the three active nests, clutch-sizes ranged from 2 to 4 eggs, compared to 3 for *P. gurneyi* and 2 for *P. caerulea*. As would be expected, the eggs of *P. caerulea* at 30 × 35 mm were considerably larger than those of *P. ellioti*, but coloration and pattern were similar.

Table 3 compares some additional behavioural and seasonal variables between the three species, for *P. gurneyi* and *P. caerulea* based on data



presented in Round & Treesucon (1986) and Round *et al.* (1989). The hatching dates for *P. ellioti* and *P. gurneyi* are within one week of each other, whereas the *P. caerulea* hatching date was 6 weeks later. The observation of a fully fledged juvenile *P. ellioti* on 3 June, the same date that a nest was found with four eggs, suggests the possibility that this species is double brooded. In all three species the period of activity at the nest began shortly after dawn and ended at dusk. Based on a single day's observation, the female *P. ellioti* made 62% of feeding visits; the female *P. gurneyi* made 44%, and the female *P. caerulea* 43% of all visits. Annelid worms were the major food item in the diet of nestling *P. ellioti* and *P. gurneyi* but constituted only one third of the diet in *P. caerulea*. The most significant dietary item of *P. caerulea* not recorded in the diet of the two smaller species were snails (Gastropoda), which accounted for 34% of the diet.

The certain predation of two of the four *P. ellioti* nests is interesting. The discovery of dismembered remains of a nestling in nest 4 rules out predation by a snake, which would swallow the prey whole, or a bird which would either do the same or would fly off with it to feed elsewhere. It therefore seems probable that nest 4 was also predated by a mammal. It was suggested that a nest of *P. gurneyi* was predated by a snake or humans (Round & Treesucon 1986).

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